

The Effect of Variation in the Proportion of Artificial and Natural Feed on Feed Selection and Consumption by Eel (*Monopterus* sp.)

Titik Sintiya^{1*}, Zaenal Abidin¹, Nuri Muahiddah¹

¹Aquaculture Study Program, Department of Fisheries and Marine Sciences, Faculty of Agriculture, University of Mataram
Pendidikan Street No. 37 Mataram, West Nusa Tenggara, Indonesia

Correspondence:

titiksintiya10@gmail.com

Received:

February 18th, 2025

Accepted:

April 28th, 2025

Keywords:

Eels, Field Snails, Water Quality

ABSTRACT

Swamp eel is one of the fishery commodities favored by the community. Swamp eel cultivation activities have not been widely developed due to the lack of feed availability to support cultivation efforts. Instead of using artificial feed, the farmer has used natural feed in the form of earthworms so far. Therefore, in this study, artificial feed and natural feed are combined to stimulate the feed acceptance of the eel. This study determined the proportion between artificial and natural feed on the level of feed consumption of swamp eel. The method used consisted of four treatments: 50% feed + worms (control diet), 75% feed + 25 snails, 50% feed + 50% snails, and 25% feed + snails 75%. The results show that the differences in the proportion of artificial and natural feed did not affect the feed selection, time response, and feed consumption by eel. Therefore, 25% snails and 75% artificial feed are recommended to stimulate the eel's feeding response.

INTRODUCTION

Swamp eel (*Monopterus* sp.) is one of Indonesia's mainstay export commodities because the demand for eels in both domestic and foreign markets tends to increase (Rahayu, 2015). In general, the demand for eels in both the local and export markets is quite high, so to meet export and local demand, efforts need to be made, namely by cultivating.

Generally, eel farming activities are carried out with the aim of meeting the target demand for eels whose availability in nature is insufficient to meet market demand. Farming efforts are also carried out with the aim of reducing the impact of declining eel populations in nature caused by human catch. In addition, cultivation activities will produce eels with a higher protein value compared to non-cultivated eels (Andasari, 2018).

Earthworms, silk worms, snails, small fish, and pellets are usually used as feed in eel farming. Worm and snail feed is a type of natural feed that is more preferred by eels compared to other feed Abidin *et al.* (2025). Earthworms contain 64-76% protein, and breeding is relatively easy. However, the price of earthworms on the market is quite high so that it will require more costs for feed, so the alternative feed used is snails. Rahayu (2015) states that snails contain 57.76% protein. The abundance of paddy field snails in rice fields is trouble to

farmers and is considered as a pest. Snails if utilized as eel feed can be mutually beneficial for farmers and eel cultivators. Sarofa *et al.* (2022) stated that snail meat has a fairly high protein of 15% with a lowfat content of about 2.4% and ash content of 24%.

Commercial feed in the form of pellets is an artificial feed for fish that is widely traded and easily available on the market. In eel farming activities, feeding in the form of pellets is not well accepted by eels (Abidin *et al.* 2025). Paste feed is an alternative option that can be used to feed eels because it can emit an attractive aroma and stimulate their appetite. It is soft and can spread the aroma into the water, making the eel more interested in eating. The strong aroma of paste feed is obtained from the addition of natural feed in the form of earthworms as an attractant. Ramadhan (2014) states that pasta feed needs to be added with attractants that can function as a stimulus to increase eel feed consumption of pasta feed. However, because the price of earthworms is quite expensive, a cheaper alternative is required, namely snails which function as an attractant that aims to increase the eel's appetite. In addition, a high level of feed consumption can also be used for better growth so that the selection of feed used must meet the nutritional needs of eels. Based on Abidin *et al.* (2015) that a high level of feed consumption will tend to produce higher growth. The purpose of this study was to determine the effect of different proportions of natural feed and pellet feed on the manufacture of pasta feed.

METHODS

Time and Place

This research was conducted for 20 days starting on August 18th and ending on September 2nd, 2024, which took place at the Fish Reproduction Laboratory, Aquaculture Study Program, Mataram University.

Tools and Materials

Equipment used in this study include aerators, HD960P CCTV camera (1 unit), DO meter (Lutron), concrete pond (2 m x 1m x 0.4 m), meter (0.1 cm), pH meter, thermometer scales (0.1 g). The materials used in this study are fresh water, eel (*Monopterus* sp.) size 10 ± 3 g, earthworms (*Lumbricus* sp.), snails (*Pila* sp.), Hi Pro Vite 781-1 pellet feed, CMC / Binder, and tissue paper.

Research Design

This study uses an experimental method by giving different types of feed with different feed compositions and snails, while the feed used for control is feed combined with worms referring to previous research (Abidin *et al.* 2025). The treatments tried are as follows:

1. Treatment A: 50% feed + 50% worms (control)
2. Treatment B: 75% feed + 25% snails
3. Treatment C: 50% feed + 50% snails
4. Treatment D: 25% feed + 75% snails

Research Procedures

• Preparation of Containers and Maintenance Media

The container used for the first stage of eel rearing was a concrete pond measuring 2 m long, 1 m wide, and 0.4 m high, totaling 1 pond. Previously, the pond was cleaned, then soaked for 3 days. After that, a water pump was installed to pump water to the filter tank. The next stage is the installation of 2 aeration points in each pond, followed by the installation of a shelter made of pipes, then equipped with a pond cover using paranet. CCTV will be installed to observe eel behavior and monitor eel feeding activities at night.

- **Test Animal Preparation**

The eels used in this study were captured eels, which then underwent an acclimatization process for approximately 7 days until no deaths occurred. The purpose of this acclimatization process is to ensure that the eel can adapt to the rearing environment until the eel is seen to respond well to the feed provided. During the acclimatization stage, eels are only given worms as a source of nutrition. The feed to be used is made from a mixture of earthworms, snails, and artificial feed.

- **Feed Preparation**

The process of making feed paste begins with selecting snails of the same size. After that, the conch is cleaned and the shell is crushed, then the contents or flesh of the conch is pulverized through a pounding process. Furthermore, the earthworms are also cleaned and the pellets are also ground until they resemble flour. The three types of ingredients will then be weighed according to the dose of each treatment and put into a container and given an adhesive in the form of 10% CMC (Suparmono, 2016) dissolved in 40% water to ensure that the feed is well attached and the texture is like a paste.

- **Research Implementation Feed Selection Frequency Test**

The frequency of feed selection test focused on determining the amount of feed ratio most favored by the eels. The test feed is formed lengthwise using a mold and placed in a row at the bottom of the pond at 4 points. The test feed is given as much as 0.2 grams and then left for 30 minutes and the experiment will be repeated 3 times a day every 18.00 - 22.00 WITA. To find out the most preferred type of feed, the frequency of selection of the type of feed is tested and the length of time the eel responds to the feed given. In this case, CCTV will be installed in the pond area. The recording results that will be recorded are the number of times the feed is eaten by the eel will be recorded as the value of the frequency of feed selection, the length of time the eel responds to the feed since the feed is placed will be recorded as the value of the length of time until the eel responds to the feed.

- **Feed Consumption Rate Test**

The feed consumption test was conducted to determine the level of eel feed consumption. The feed consumption test lasts for 5 days. Feed for each treatment will be weighed as much as 0.5 grams and formed to resemble a sphere of 2 spheres in each treatment. The test feed is then placed on the bottom of the pond randomly. Any feed that is eaten by the eel will be immediately replaced with new feed and uneaten feed will be discarded after 20 minutes then replaced with new feed and repeated until the feed runs out. The eels will be fed every 18:00 WITA. The test data is the amount of feed eaten (grams) by the eel.

Data Analysis

Data obtained from the results of the study in the form of frequency test data on the selection of feed types and data on the length of time the eel responds to feed and data on the level of consumption of eel feed (*Monopterus* sp.) All data obtained will be analyzed using SPSS and tested using the Krusal Wallis test which will be presented in graphical form.

RESULTS

Frequency of Feed Selection by Eel

The frequency of feed selection by eels with different feed compositions can be seen in Figure 1.

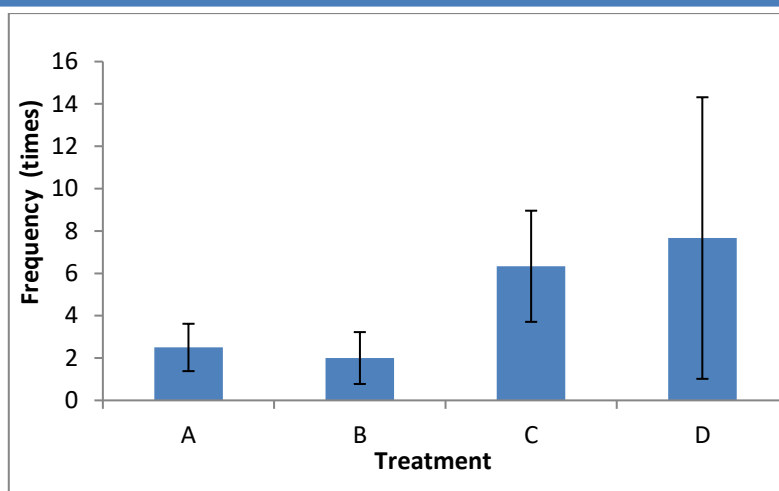


Figure 1. Frequency of Feed Selection by Eel

Kruskal Wallis test showed that different feed compositions did not affect ($P > 0.05$) the frequency of feed selection by eels.

Length of Time for the Eel to Respond to the Feed

The time span for eels to respond to different types of feed with different feed compositions can be seen in Figure 2.

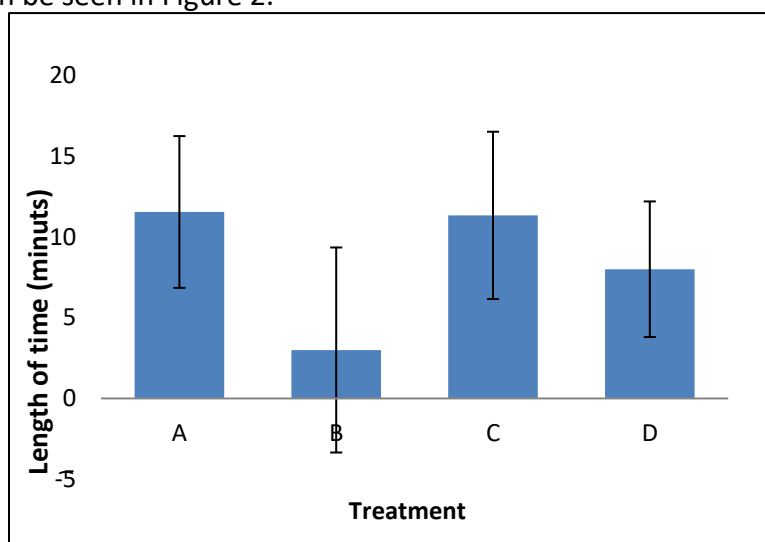


Figure 2. Length of Time Until the Eel Responds to the Feed

Kruskal Wallis test showed that different feed composition in each treatment did not affect ($P > 0.05$) the length of time required for the eel to respond to feed. The time required for the eel to respond to feed ranged from 88-184 minutes.

Feed Consumption Rate

The rate of feed consumption by eels fed with different compositions can be seen in Figure 3.

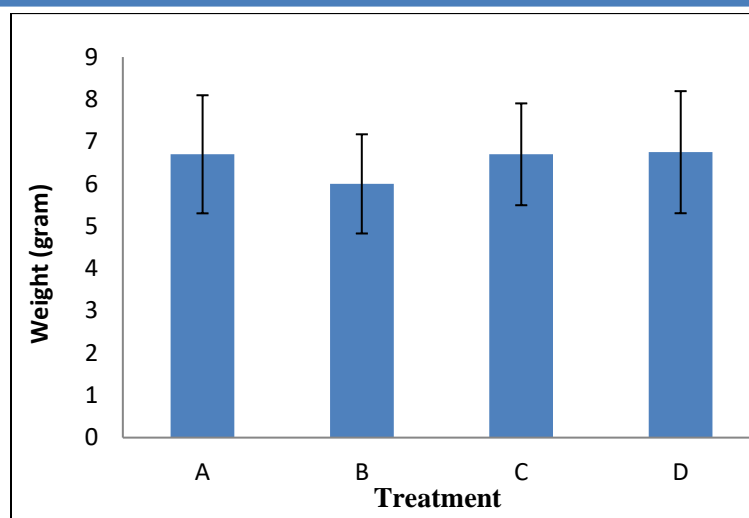


Figure 3. Feed Consumption Rate

Kruskal Wallis test showed that treatments with different feed compositions had no significant effect ($P > 0.05$) on eel feed consumption rate. The feed consumption rate ranged from 60-69 times the feed consumed.

Water Quality

The values of the water quality parameters in the rearing pond were measured to determine the condition of the water in the pond. The results of water quality measurements during rearing include temperature, pH, and DO.

Table 1. Water Quality

No.	Parameters	Value	Source
1.	Temperature (°C)	27 - 31	25- 32 (Soelistyowati, 2019)
2.	pH	7.2 - 8	7-8 (Mashuri <i>et al.</i> , 2014)
3.	DO (mg/l)	4.5 - 6	4.5 - 7.5 (Nhan <i>et al.</i> , 2019)

DISCUSSION

In this study, the treatment with natural worm feed and the treatment with natural snail feed had the same level of feed consumption. The use of paddy field snails as a natural feed gave the same response as the feed supplemented with worms. Snail is a natural food that is favored by eels because it has high nutritional value and has a distinctive odor so that it can increase the eel's appetite. According to Luqman (2014), snails are pests that can be easily found in rice fields and have a fairly high nutritional content with 51.8% protein.

Figure 1 shows that feed with 50% worms and feed with 25% snails had the same selection frequency. Because both types of natural food used are equally favored by eels, earthworms can be replaced with snails. Imaduddin (2019) stated that snails are natural food for eels that have a fishy odor that can stimulate fish to approach the source. In addition, snails are often considered as pests that damage rice plants (Lonta *et al.* 2020). Puspa (2016) states that the meat of snails can be used to feed eels, snails and carp snails are easily found in rice fields. In addition, Yuga (2023) states that the protein content of rice paddy snail meat is 75.68% higher when compared to protein in silkworms, which is 66.26% and based on Anggraini *et al.* (2018) rice paddy snails have a good protein content so that they can optimize the growth of biota that consume them.

Based on the length of time the eels respond to feed in each treatment, feed with 50% worms and feed with 25% snails get the same time or there is no difference in the length of time. Feed with additional worms and feed with additional snails are equally favored by eels so it does not take a long time for eels to finish the feed given. This is due to the use of natural feed in this study that has a fishy odor such as paddy field snails and worms can quickly stimulate the eel's appetite. According to Ismi's research (2014), the aroma contained in the extract of paddy field snails is more pungent so that there is a stimulation of the fish's willingness to eat the feed, seen from the absence of the rest of the feed when given. This is in line with Regar (2018) that snails can be used as a protein source feed because they contain 51.08% protein.

Based on the results of feed consumption rates in each treatment, feed with 50% worms and feed with 25% snails there is no difference. In this study, the feed paste that has been made is then formed into small balls to make it easier for eels to spend feed in one mouth opening so that eels are not easily full and eels can spend more feed in one test. This is in accordance with the opinion of Putra (2015) that smaller feed will be eaten and swallowed immediately, while larger feed will be torn into pieces first and then swallowed.

Earthworms and snails were the natural food used in this study. Based on Figure 3, it can be seen that there is no difference in feed consumption because the two types of natural feed used are indeed the preferred feed for eels. Worms are commonly used as eel feed in many studies but are often complained about because they are expensive and increase production costs, so in this study snails are used as an alternative to worms. The use of snails in addition to their high nutritional content and favored by eels, can also reduce feed production costs (Ratri *et al.* 2017) and are also easily available.

CONCLUSION

The conclusions drawn from the research are as follows:

1. The addition of octopus ink extract in the feed of catfish significantly improved the growth parameters (absolute weight, absolute length, specific growth rate, and feed conversion ratio).
2. The best treatment was achieved at the dose of P5 (160 ml/kg), which resulted in absolute weight of 1.26 g, absolute length of 1.5 cm, feed conversion rate (FCR) 1.66 and specific growth rate of 0.57 %/day.

ACKNOWLEDGEMENT

I sincerely thank my supervisor Dr. Zaenal Abidin, S.Pi., M.Si. and Mrs. Nuri Muahiddah S.Pi., M.Sc. Parents and family and good people who have helped in the research process and the closest and dearest people and who always provide support to the author to remain consistent in completing the study.

REFERENCES

- Abidin, Z., Junaidi, M., Cokrowati, N., & Yuniarti, S. (2015). Growth and feed consumption of catfish (*Clarias* sp.) fed with local raw materials. *Depik*, 4(1), 36.
- Abidin, Z., Lumbessy, S. Y., Lestari, D. P., Alim, S., & Rahmadani, T. B. C. (2025). Response of Eel Fish (*Monopterus* sp) to Various Types of Feed. *Unram Fisheries Journal*, 15(1), 128.

- Adli, A. (2020). Effect of Different Stocking Densities on the Growth Rate of Paddy Eel (*Monopterus albus*) in Biofloc Media. *Journal of Biology and Science Education*. Vol.3 No 2.
- Anggraini, W., Abidin, Z., & Waspodo, S. (2018). The Effect of Feeding Rice Snail on the Growth and Survival of Sand Lobster (*Panulirus homarus*). *Unram Fisheries Journal*, 8(2), 25.
- Astiana, A. K. (2018). Effect of Different Water Levels on Growth and Survival of Eel (*Monopterus albus*). Doctoral Dissertation, University of Mataram.
- Aulianisha, N (2023). Response of Eel (*Monopterus albus*) to Different Types of Feed. Thesis. Mataram: University of Mataram.
- Falahudin, I. (2016). The Effect of Feeding Rice Conch and Rice Washing Water on the Growth of Eel (*Monopterus albus* zuiewu). *Journal of Biota*, 2(1), 112-119.
- Fujianti, T., Efrizal, & Rahayu, R. (2015). Growth Rate of Rice Field Eel (*Monopterus Albus*) by Feeding Various Feeds. *Journal of Biology, Andalas University*, 4(1), 50-56.
- Imaduddin, A., Zulkarnain, & Iskandar, M. D. (2019). The Use of Earthworm (*Lumbricus rubellus*) Bait Attractors on Floating Bagan Catches in Palabuhan Ratu Bay. *Journal of Marine Fisheries Research*, 3(1), 001-011.
- Lesmana, I., Firdaus, R., M., & Yusni. (2015). Effect of Different Feeds on the Growth of Rice Field Eels (*Monopterus albus*) Raised in Barrels. *Journal of Aquaculture Research*, 14 (3) 163-171.
- Lonta, G., Pinaria, B. A., Rimbing, J., & Toding, M. M. (2020). Population of Rice Snail Pests (*Pomacea caniculata* L.) in Baits and Traps in Rice Paddy (*Oryza sativa* L.) Plants. In *Cocos*, 12(1), 2.
- Mashuri, M., Sumarjan, M., & Abidin, Z. (2012). Effect of Different Feed Types on the Growth of Rice Field Eel (*Monopterus albus* zuiewu). *Unram Fisheries Journal*, 1(1), 1-7.
- Nuryadin, K., Rahim, R. A. & Aminim. (2020). Analysis of the Use of Organic Waste on the Growth and Survival of Rice Field Eels (*Monopterus albus*). *Journal of Pantura Fisheries* Vol.3, No.1
- Pangerang, A., Sa'adah, S., & Hidayat, A. (2015). Effect of Media Treatment on Growth and Survival of Rice Field Eel (*Monopterus albus* zuiewu). Proceedings of the National Seminar on Science and Technology 2. Universitas Pendidikan Indonesia, Bandung.
- Putra, A.K. (2015). Effect of Animal Feeding on the Growth of Paddy Eel (*Monopterus albus*) in Water Medium. *Dinamik Maritim*, Vol V (1) (21-27).
- Ramadhan, Arief, M., & Yudiarto. (2014). Effect of Addition of Different Attractants in Pasta Feed on Retention of Protein, Fat, and Energy of Eel Fish Seeds (*Angulia bicolor*) Stadia Elver. *Journal of Fisheries and Marine Sciences* Vol 4 No.2.
- Regar, N, M., Crisye, R., & Saerang, P. (2018). Effect of Feeding Rice Snail Flour (*Pila ampulacea*) as a Substitute for Fishmeal in Feed on Egg Quality of Quail (*Cutornix japonica*). *Zotoek Journal* Vol.38 No.1, 1-8.
- Ridha, A & Rinaldi. (2021). Utilization of snails (*Pomacea canalicunata*) as Fresh Feed to Accelerate the Growth of Dumbo Catfish Seeds (*Clarias gariepinus*). *Scientific Journal of Aquatic Studies* 3(1),28-35
- Santoso, R. (2014). Addition of Different Attractants in Pasta Artificial Feed on Growth and Feed Conversion Ratio of Eel (*Monopterus albus*) with Recirculation System. Thesis. Department of Aquaculture, Faculty of Fisheries and Marine Science, Universitas Airlangga, Surabaya: Airlangga University.

- Sarofa, U., Wicaksono, L. A., & Wayuni, A. I. (2022). Effect of Tapioca and Margarine Concentration on the Characteristics of Rice Snail (*Pila ampullacea*) Burger Patty. *Journal of Tropical Agricultural Engineering and Biosystems*, 10(2), 101.
- Yuga, D., Ananda, T. H., Hidayat, N. (2023). Development of High Protein Fish Feed from snails (*Pomacea canalicunata*) for Tilapia (*Oreochromis niloticus*) Feed and its Application in the Real Lecture Work Program in the Community of Sungai Petai Village. *Journal of Works*.